Model-Centric Software Adaptation

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Software must be constantly adapted to changing requirements. The time scale, abstraction level and granularity of changes may vary from short-term, fine-grained adaptation to long-term, coarse-grained evolution. Furthermore, long-lived, large-scale systems must cope with the fact that changes may not be globally consistent.

We argue that, in order to effectively and efficiently deploy changes and cope with inconsistencies, adaptive application must be built on an infrastructure that is not just model-driven, but is both model-centric and context-aware. Specifically, this means that high-level, causally-connected models of the application and the software infrastructure itself should be available at run-time, and that changes may need to be scoped to the run-time execution context.

We first review the dimensions of software adaptation and evolution, and then we show how model-centric design can address the adaptation needs of a variety of applications that span these dimensions. We demonstrate through concrete examples how model-centric and context-aware designs work at the level of application interface, programming language and runtime.

We conclude with our research agenda for a model-centric development environment that supports dynamic software adaptation and evolution.